DAY 4

*Estimation game. Challenge students to guess the mass of an object in grams. (Winners will be announced at the beginning of lunch.)

ACTIVITY 4-1: **YEAST ENZYMES**

OBJECTIVE(s): After completing the activity, students will be able to:

▷ observe the effects of yeast enzymes and their ability to produce gases (oxygen (O_2) and hydrogen (H_2)) from hydrogen peroxide (H_2O_2).

MATERIALS:	
2 packets of dry yeast	40 wood splints
15 cereal bowls	15 votive candles/matches
15-9oz plastic cups	4-16oz bottles of hydrogen peroxide

BACKGROUND INFORMATION:
Enzymes are proteins that act as catalysts. They cause chemical changes to occur, and affect the rate of change, but they are not part of the end product. Enzymes are used as catalysts to speed up certain reactions. For example, amylase is an enzyme found in saliva that starts the digestive process. It immediately starts to break down starch into sugars.

Hydrogen peroxide is broken down to hydrogen gas, oxygen gas, and water with the use of an enzyme present in yeast.

$$4\ H_2O_2 \rightarrow\rightarrow 2\ H_2\uparrow + 3\ O_2\uparrow + 2\ H_2O$$

PROCEDURE:
1. In this activity, students will add yeast enzymes to liquid hydrogen peroxide (H_2O_2) to facilitate the release of hydrogen (H_2) and oxygen (O_2) gases.
2. Students should work in groups of 2.
3. Students need to follow instructions on Student Activity Sheet 4-1, steps 1-4.
4. Instructor need to inform students to stir the yeast and hydrogen peroxide mixture.
5. Students need to wash their hands after handling hydrogen peroxide.
6. Another option - raw liver (beef) can be used instead of the yeast to obtain a similar reaction.
7. Discussion of yeast and the making of bread.

DISCUSSION QUESTIONS:
1. What happened as you sprinkled the yeast into the hydrogen peroxide?
2. Where did the bubbles come from?
3. What happened when you held the glowing wood splint near the bubbles?

ACTIVITY 4-2: **MAKING ROCK CANDY CRYSTALS**

OBJECTIVE(s): After completing the activity, students will be able to:

▷ observe a saturated liquid turning to a solid (precipitation). (Liquid state to solid state)

MATERIALS:	
2 hot plates	2 sauce pans
2 wooden spoons	30 baby food jars
30 craft sticks	string
10 lbs granulated sugar	40 medium paper clips

BACKGROUND INFORMATION:

When certain liquids and gases cool and lose water, crystals are formed. Crystals are made up of molecules that fit neatly together in an orderly package. All crystals of the same material have the same shape, regardless of the size.

ICE (H_2O)

TABLE SALT (NaCl)

SUGAR ($C_{12}H_{22}O_{11}$)

Recipe for sugar solution:

Mix 10 cups of boiling water with 10 lbs of sugar.

PROCEDURE:

1. Students will make rock candy crystals using a saturated sugar solution.
2. Each student will make her/his own sugar crystals.
3. Instructors should bring water to a boil, then slowly stir in sugar until no more will dissolve (see approximate amounts above). Allow to cool (5 minutes). Then pour into students jars, approximately 3/4 full.
4. Students should follow the instruction on Student Activity Sheet 4-2 to prepare their jars while instructors are preparing the sugar solution.
5. Some crystals should form in a few days. Some may grow to be half an inch on each side. To save them, take them out of the solution and kept them dry.
6. An incubator can be used to control the cooling of the sugar solution for the formation of larger crystals.

ACTIVITY 4-3: **TRANSPIRATION**

OBJECTIVE(s): After completing the activity, students will be able to:

- ▷ observe and discuss the condensation process (gas to liquid) that takes place during transpiration.
- ▷ understand the role that plants play in the water cycle.
- ▷ observe and explain the function of stomata.

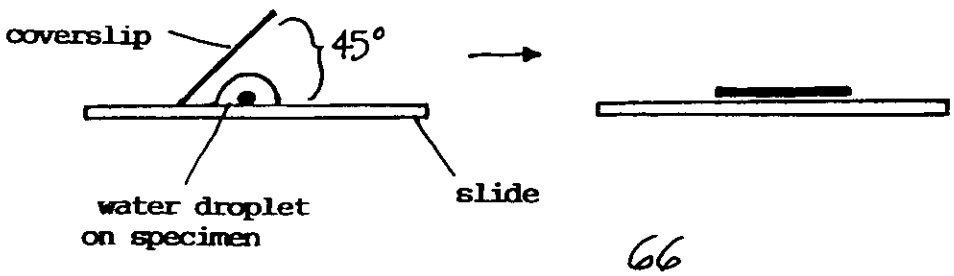
MATERIALS:	
1 large ivy geranium plant	60-9oz plastic cups
30 (5"x 4") index cards	2 rolls of clear tape
1 jar Vaseline	2 plastic pitchers
10 microscopes	10 slides/coverslips
10 medicine droppers	5-250ml beakers

BACKGROUND INFORMATION:

Transpiration is the process in which water is lost from plants. During the growing season water continuously moves from the roots to the leaves. Plants use approximately one percent of their total intake of water in photosynthesis and other plant functions. The remaining water (~99%) is lost through the process of transpiration. This water escapes through the plant's stomata as water vapor (gas). Stomata are pores that regulate the passage of air and water to and from a leaf. The stomata open and close to control the rate of transpiration. Most plants have their stomata open during the day and closed during the night. On very hot days, plants close their stomata to conserve water. (A good example of stomata can be seen in the ivy geranium plant.)

Preparation of a Wet Mount Slide

To prepare a wet mount slide, place the specimen to be examined on a clean slide. If the material is dry, place it directly on the slide and add a drop of water. Then cover the specimen with a coverslip. To avoid trapping air under the coverslip, hold the coverslip at a 45° angle to the slide, and move the coverslip across the slide until it touches the water. Immediately lower the coverslip until it's parallel to the slide surface. Remove trapped air bubbles by gently tapping with a pencil.



PROCEDURE:

1. In this activity, students will be using the leaves of an ivy geranium plant to observe the process of transpiration. They will also locate plant stomata using microscopes.
2. Students will work individually to set up Part A and in groups of three for Part B.
3. In Part A, each student should obtain the following materials: 2-9oz plastic cups, 1 index card, and 1 ivy geranium leaf. Students should follow the directions on Student Activity Sheet 4-3, Part A, to complete this part of the activity.
4. In Part B, microscopes should be set up around the room so students can work in groups of 3.
5. Instructors should demonstrate the correct technique for preparing wet mount slides using ivy geranium leaf. (See background information.) Instructors need to also go over correct microscope techniques before having students start Part B. (To obtain the transparent layer of cells that contain the stomata, break the ivy leaf in half and tear the transparent bottom layer off.)
6. Students should follow the directions on Student Activity Sheet 4-3, Part B, to complete this part of the activity.

* This activity works best on a sunny day. You can replace this activity by using a gallon plastic bag and rubber band. Place the plastic bag over part of a tree or shrub outside and secure it with the rubber band.

DISCUSSION QUESTIONS:

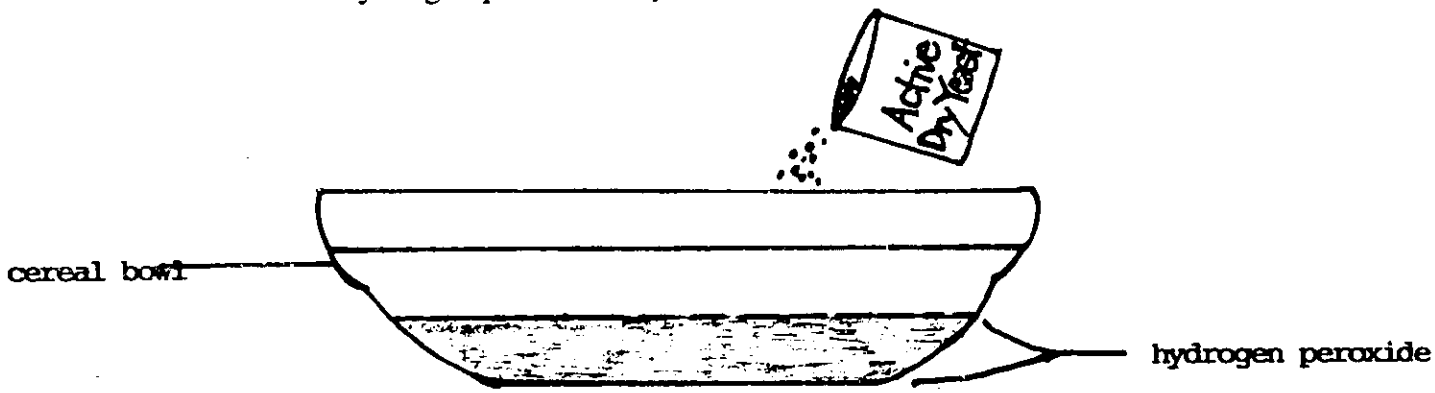
1. What did you observe in the upper glass?
2. How did the drops of water get in the upper cup?
3. Discussion of the importance of plant transpiration in the water cycle.

Student Activity Sheet 4-1

YEAST ENZYMES

1. Obtain a cereal bowl, a half cup of hydrogen peroxide, a votive candle, 1/4 teaspoon of yeast, and 2 wood splints.

2. Pour the hydrogen peroxide into the cereal bowl. You should have about 1-2 cm of hydrogen peroxide in your cereal bowl.



3. Have your instructor light the votive candle. Then sprinkle the yeast evenly over the hydrogen peroxide.

4. Light the wooden splint with the candle, then blow it out so the end glows. Hold the glowing wooden splint over the bubbles.

5. What happened when you put the glowing wooden splint over the liquid? Why do you think this happened?

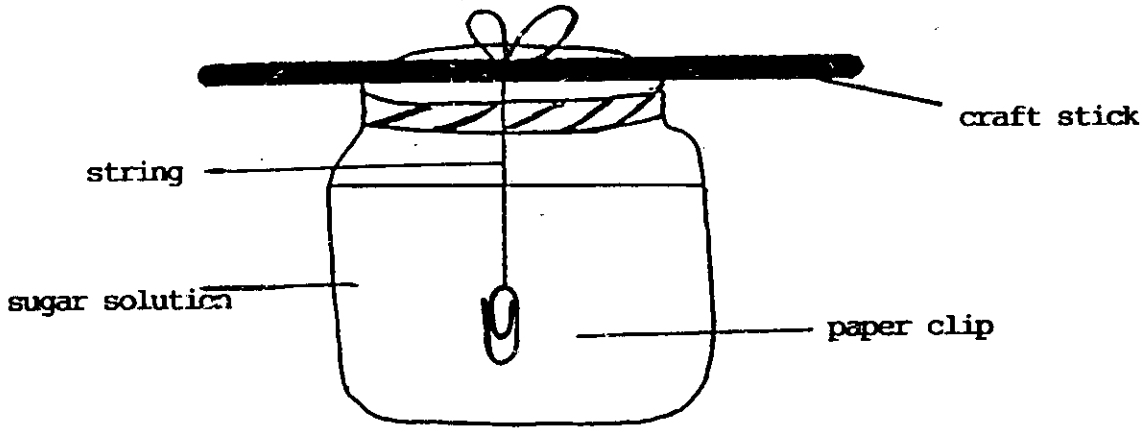
Student Activity Sheet 4-2

ROCK CANDY CRYSTALS

1. Get a baby food jar and a piece of masking tape (~5 cm). Write your name on the tape and place it on the outside of your jar.

2. Obtain a piece of string that is 15 cm in length. Tie one end to your paper clip and the other end to your craft stick.

3. Balance the craft stick on the top of your jar, checking to make sure the paper clip hangs about 2/3 into the jar.



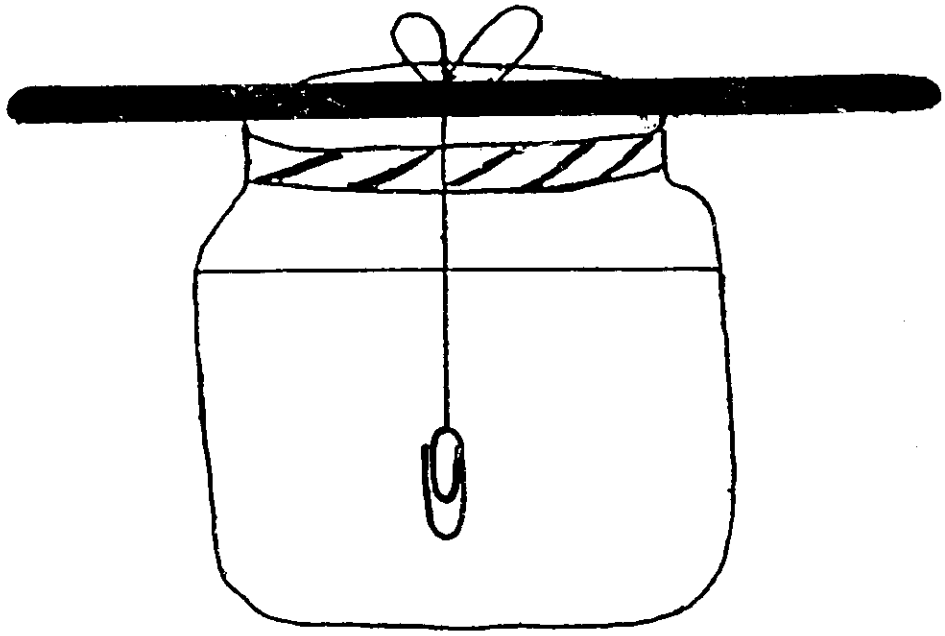
4. Remove the paper clip from the jar and take the jar to the designated area to add the sugar solution.

5. Your instructor will help you pour the solution into your jar (3/4 full). **(Solution is very hot, so be careful.)**

6. Place the craft stick back on top of the jar making sure that the paper clip is hanging straight down in the liquid. It should be in the center of the jar, not to close to the sides.

7. Check at the end of the day and make any observations in the space provided below.

8. Check again a few days later and make observations. Draw what you see in your baby food jars.



Student Activity Sheet 4-3

TRANSPIRATION

Part A:

1. Fill one of your plastic cups 3/4 full of water.

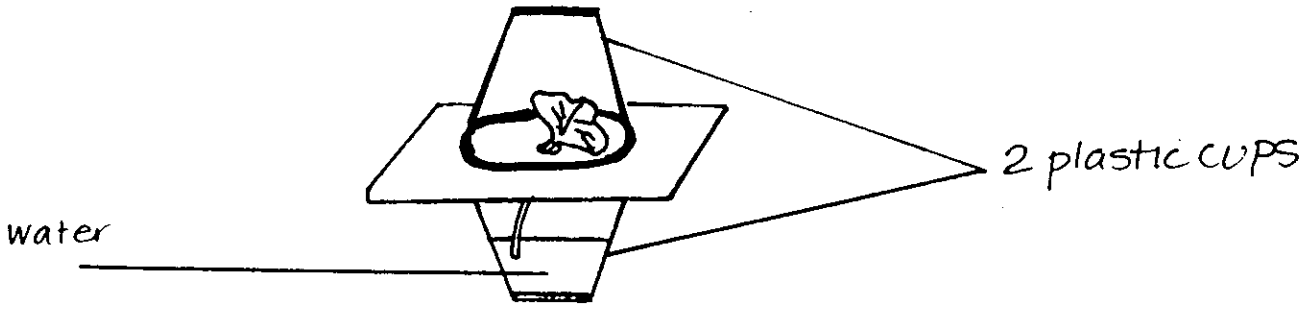
2. Get an index card and punch a small hole in the middle with a sharpened pencil.

3. Obtain a healthy ivy geranium leaf (leaf and stem).
   Insert the stem of the leaf into the hole in the index card.

4. Place the index card with the leaf stem downward over the jar with water. Make sure the stem is underwater. If not, add more water.

5. Close the hole in the index card with Vaseline to prevent evaporating water from circulating upward.

6. Put Vaseline around the rim of the second cup. Place this cup over the leaf so that it rests on the index card/cup as shown below.



7. Set aside in a sunny location for 2 hours. Return later to make observations.

Part B:

8. Obtain a ivy geranium specimen from your instructor and prepare a wet mount slide.

9. Work in groups of 3 at a microscope. The hunt for stomata should be easy. Look for cells that are shaped like footballs. See example below.